

reconsideration and further examination.

About The Invention

The present invention relates generally to apparatus and methods for packaging multiple integrated circuits that operate at different voltages in a single package. In a particular embodiment, a ball-grid array (BGA) package, which includes multiple layers of conductors separated by dielectric layers, is arranged such that the power planes, ground planes, and connection balls associated with each of at least two integrated circuits are separated from each other by at least a distance that is based upon the difference in operating voltages between the integrated circuits.

Election/Restriction

The Examiner has required restriction to either the invention of Group I which includes Claims 1-7 and 13-17, or to the invention of Group II which includes Claims 8-12. The Examiner states that during a telephone conversation with Mr. Schmitt on 16 March 2003, a provisional election was made without traverse to prosecute the invention of Group I.

Applicants hereby affirm the election without traverse to prosecute the invention of Group I, which includes Claims 1-7 and 13-17.

Non-elected Claims 8-12 have been cancelled from this application. Applicants reserve the right to pursue such non-elected Claims in a divisional application.

Objections to the Drawings

The Examiner has objected to the drawings. The Examiner states that all figures are improperly cross-hatched and that the cross hatching patterns should

be selected from those shown in the MPEP based on the material of the part. The Examiner also objects to the drawings because reference numeral "16" is not mentioned in the description.

With respect to the objection based on reference numeral "16", Applicants have amended the specification to overcome this objection. More particularly, Fig. 2A shows the solder balls of a ball grid array package and identifies these solder balls with reference numeral 16. The specification is amended at page 5, line 20 to include the number "16" after "solder balls. This amendment to the text of the specification is clearly and fully supported by Fig. 2A and the existing text of the specification. No new matter has been added. Applicants respectfully submit that this amendment to the specification overcomes the objection to the drawings in connection with reference numeral "16".

With respect to the objections based on cross-hatching, Applicants respectfully traverse the Examiner's objections to the drawings and request that these objections be withdrawn.

Firstly, the Examiner states that all figures are improperly cross-hatched. Applicants respectfully assert that Figs. 1A, 1B, 2A, 2B and 3 simply do not contain any cross-hatching, are not intended to contain any cross-hatching, and that cross-hatching is not appropriate for Figs. 1A, 1B, 2A, 2B and 3. Therefore the objections to these figures are improper and should be withdrawn.

Secondly, the Examiner states that the cross-hatching pattern used should be that shown in the MPEP based on the material used. Applicants respectfully assert that the cross-hatching is in fact used. The MPEP shows a cross-hatch pattern of lines angling upwardly from left to right at approximately 45 degrees that is to be used for metal. The cross-hatched sections in Figs. 4A-D use exactly that cross-hatch pattern on various conductors. It is well known that electrical conductors are typically metal. In view of the foregoing, Applicant respectfully asserts that the objections based on cross-hatching are improper and should be withdrawn.

Applicants also note for the record that a Notice of Draftsperson's Patent Drawing Review has not been received in this case. A clean copy of the drawings are provided for the Examiner's convenience.

Rejections under 35 USC 112, second paragraph

Claims 3-5 and 13-17 have been rejected under 35 USC 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. More particularly, the Examiner states that: (a) Claims 3, 5, and 15 recite a standard that is indefinite since the defined standard is subject to change in the future; (b) Claims 4 and 13 recite a plurality of layers and that a comma is missing between ground layer and bottom layer which makes those Claims indefinite; and (c) Claim 13 recites a grammatically incorrect "plurality sets" and an unclear phrase "to be mounted".

Claims 3, 5 and 15 have been amended to remove the reference to the particular standard. Applicants respectfully submit that this amendment overcomes the rejection of Claims 3, 5 and 15 under 35 USC 112, second paragraph.

With respect to the rejection of Claims 4 and 13 for an alleged "missing comma", Applicants respectfully traverse these rejections and request that they be withdrawn. It is a well accepted writing style in the English language to not use a comma after the last element in a list preceding the word "and". However, regardless of this fact, there is simply no ambiguity in the claim language regarding the physical arrangement of the ground layer and the bottom layer with respect to each other. The bottom layer and the ground layer exist at different levels of the package and are separated by a dielectric. This is shown in Fig. 3, and explained in the specification at page 6, lines 11-15. The presence or absence of a comma after "ground layer" does not change the meaning of the claim language whatsoever.

Claim 13 has been amended to correct "a plurality sets" to read "a plurality of sets"; and to remove the "to be mounted" language. Applicants respectfully submit that this amendment overcomes the above-mentioned rejection.

Rejections under 35 USC 102(b)

Claims 1-4, 6, 7, 13-14 and 16-17 have been rejected under 35 USC 102(b) as being anticipated by Koepf (US Patent 5,138,436).

Independent Claims 1 and 13 have been amended to make clear that the separation of conductors is not just for isolation, but that the distance by which they are separated within the BGA package is based upon the expected difference in voltage between the conductors of the package that would be experienced during operation.

Rejections under 35 USC 103(a)

Claims 5 and 15 have been rejected under 35 USC 103(a) as being unpatentable over Koepf (US Patent 5,138,436).

Claims 5 and 15 have been amended to remove the reference to a particular standard. Additionally, Claims 5 and 15 depend respectively from amended independent Claims 1 and 13 which are discussed above.

In view of the foregoing, Applicants submit that the rejections under 35 USC 103(a) have been overcome.

Conclusion

All of the rejections in the outstanding Office Action of 20 March 2003 have been responded to, and Applicant respectfully submits that the pending

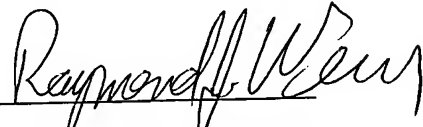
Appl. No. 10/024,936

Claims 1-7 and 13-17 are now in condition for allowance.

Attached hereto is a marked-up version of the changes made to the specification by the current amendment. The attached page is captioned **"Version with markings to show changes made"**.

Applicants respectfully request that a timely Notice of Allowance be issued in this case.

Respectfully submitted,

By 
Raymond J. Werner
Reg. No. 34,752

Dated: 11 July 2003
Portland, Oregon

V rsion with markings to show changes made

In the Specification

Please replace the paragraph beginning at page 5, line 19 with the following:

FIG. 2A shows a perspective view of package 10 having a plurality of solder balls **16**, which are used for connecting to one another and to other external devices. FIG. 2B shows a bottom view of package 10. As shown in FIG. 2B, there are two sets of external electrical connection contacts 22 and 24 in the form of solder balls, associated with devices 2 and 4, respectively. Two spacing gaps 26 and 28 separate the two sets of external electrical connection contacts in two sections to maintain electrical isolation between devices 2 and 4. Spacing gaps 26 and 28 are created by removing the external connection contacts in the pre-selected areas. Spacing gaps 26 and 28 are also maintained at the minimum physical widths in accordance with Table 6-1 of the ANSI/IPC-2221 standard described above.

In the Claims

- 1 1. (Amended) A ball grid array (BGA) package **assembly** having a plurality of
- 2 external connection contacts, comprising:
- 3 a first device, **disposed on the BGA package, and** having a plurality of
- 4 electrical connections connected to a first set of the external electrical connection
- 5 contacts; and
- 6 a second device, **disposed on the BGA package, and** having a plurality
- 7 of electrical connections connected to a second set of the external electrical
- 8 connection contacts;
- 9 wherein the first and second sets of the external electrical connections are
- 10 segregated in two sections which are electrically isolated from each other, **and**

11 the two sections are separated by at least a first distance wherein the first
12 distance is based upon an expected difference in operating voltage
13 between first device and the second device.

1 2. (Amended) The package of claim 1, wherein the first distance is [two
2 sections are separated by spacing gaps] in accordance with a predetermined
3 standard.

1 3. (Amended) The package of claim 2, wherein the standard specifies a
2 physical separation distance between conductors based at least upon a
3 voltage between the conductors [is according to an ANSI/IPC-2221 standard].

1 5. (Amended) The package of claim 4, wherein the standard specifies a
2 physical separation distance between conductors based at least upon a
3 voltage between the conductors [is according to an ANSI/IPC-2221 standard].

1 13. (Amended) A ball grid array package, comprising:
2 a plurality of layers, including a signal layer, a power layer, a ground layer
3 and a bottom layer;
4 wherein each of the layers includes a plurality of sets of electrical
5 conductors [connections] that are segregated into a corresponding plurality of
6 sections which are electrically isolated from one another by a minimum
7 distance based upon an expected voltage difference between the sets of

8 lectrical conductors, each of the plurality of sets of electrical [connections]
9 conductors being adapted for connection to a corresponding integrated
10 circuit [are for respectively connecting to a plurality of devices to be mounted
11 within the package].

1 15. (Amended) The package of claim 14, wherein the predetermined standard
2 specifies a physical separation distance between conductors of the
3 package based at least upon a voltage between the conductors [plurality of
4 sections are segregated in accordance with the an ANSI/IPC-2221 standard].